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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/052,347	01/23/2002	Katsuhide Manabe	P 282475	4113
	7590		F00-219-USdiv3-c	
	12/08/2004		EXAMINER	
			MULPURI, SAVITRI	
			ART UNIT	PAPER NUMBER
			2812	
DATE MAILED: 12/08/2004				

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/052,347	Applicant(s) MANABE ET AL.	
	Examiner Savitri Mulpuri	Art Unit 2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 September 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 19-52 and 119-127 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 19-52, 119-127 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

This communication is in response to the applicant's response filed on 9/21/2004.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 19-52, 119-127 are rejected under 35 U.S.C. 102(b) as being anticipated by Sayyah (Doctoral Dissertation presented in Feb. 1986).

Sayyah discloses a method for producing a gallium nitride group compound semiconductor by MOCVD technique: setting a mixing ratio of silicon-containing gas to at least one other raw material gas (SiH_4 / TMG+TMA) during vapor phase epitaxy at a range over which a conductivity of gallium nitride group compound semiconductor increases substantially proportionally with said mixing ratio so as to obtain a desired conductivity as in claim 19 or concentration as in claim 20 of the gallium nitride group compound semiconductor, forming gallium nitride group nitride group compound semiconductor by feeding silicon containing gas and other raw material gas at mixing ratio, wherein the gallium nitride group compound semiconductor comprises $\text{Al}_x\text{Ga}_{1-x}\text{N}$ or GaN with concentration of $1 \times 10^{17} / \text{cm}^3$ to $1 \times 10^{19} / \text{cm}^3$. Page 125, first paragraph and table 14; fig. 32 and related description). Sayyah clearly shows silicon concentration increases with increasing ratio of silane to mixture of TMG and TMA (see the plot fig. 32) and increase in silicon concentration increases the conductivity because

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conductivity is mobility of carriers times concentration. With respect to claims 28-30,34-36. Sayyah discloses electron concentration not less than $1 \times 10^{16} / \text{cm}^3$ in the range of $1 \times 10^{17} / \text{cm}^3$ - $1 \times 10^{19} / \text{cm}^3$ depending on mole fraction as similar to instant claims(see page 37). With respect to claims 25-27,31-36, it is inherent in the invention of sayyah, the conductivity is similar because concentration of silicon in GaN based layer and growth technique to grow GaN based layer are similar in both instant invention and in the invention of Sayyah, wherein conductivity is carrier mobility times the concentration of silicon.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 37-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sayyah in combination with Admitted prior art.

With respect to claims 37-52, though Sayyah teaches growing GaN based layer at temerarure as low as 500 C, but does not specifically mention growing GaN based layer on a gallium nitride based buffer layer, wherein buffer layer is grown at a temperature lower than GaN layer growth temperature. Admitted prior art teaches GaN layer grows directly on sapphire substrate or buffer layer of aluminum nitride. However such low temperature buffer layer growth is obvious because low temperature growth

buffer layer inhibits the creation of defects or dislocations in the GaN layer to be grown on buffer layer.

Response to Arguments

Applicant's arguments filed 9/21/2004 have been fully considered but they are not persuasive. Applicant argues that Sayyah does not teach organ metallic compound vapor phase epitaxy (OMCVD). However, Sayyah teaches MOCVD to grow silicon doped GaN based layer, and MOCVD is similar to OMCVD (see page 21).

Applicant's arguments in entire page 4 are irrelevant to the instant claimed limitations. In page 5, applicant admits that Sayyah teaches Si is shallow donor but argues that Sayyah never measures electron concentration. Applicant argues that conductivity is never changed by Si doping. However sayyah teaches Si dopant concentration is linearly proportional to the ratio of silicon to total of TMG and TMA (see figure 32). In sayyah electron concentration can be calculated by the conductivity, which is dependent on dopant concentration. In next communication, Applicant must provide proof to support to applicant's argument that electron concentration does not increase even when Si concentration increases in Sayyah reference.

Applicant argues that there is no motivation to combine sayyah with teachings of admitted prior art of growing GaN directly on sapphire or on buffer layer formed on substrate. However, growing buffer layer first and then followed by GaN doped layer reduces dislocation or defects, which otherwise present due to mismatch of sapphire and gallium nitride based semiconductors. Moreover, admitted prior art teaches art

recognized equivalence of growing GaN directly on sapphire or on buffer layer, which does not require motivation to combine. (see page 1, last paragraph).

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Savitri Mulpuri whose telephone number is 571-272-1677. The examiner can normally be reached on Mon-Fri from 8 a.m. to 4.30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling, can be reached on 571-272-1679. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR.


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Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should

you have questions on access to the Private PAIR system, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free).



Savitri Mulpuri
Primary Examiner
Art Unit 2812